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GENERAL INTELLIGENCE AND WAGES[1]

SUMMARY

Unsatisfactory discussion of the subject by economists, 690. — The Binet tests of general intelligence, 691. — Applications in educational psychology, 692. — Application to relation between intelligence and earnings, 694. — Large possibilities of the method, 697. — Need of separating tests of intelligence from those testing environment and schooling, 698. — Vocational guidance, 701. — Conclusion, 703.

Much as has been written on "differences of wages" and their relation to intelligence and ability, the discussion of the subject by economists has been far from satisfactory. The early writers, beginning with Adam Smith, were not disposed to give much weight to general intelligence. Later writers, notably J. S. Mill, gradually recognized general intelligence to be important in affecting the productiveness of labor. Others of still later date, such as F. A. Walker, suggested that general intelligence might affect either the general level of wages or differences in wages; and, finally, some recent writers find a tendency for wages to be adjusted, other things equal, to differences of efficiency, ability, or intelligence.[2] In all of this discussion the chief difficulties have been the lack of a clear definition of ability or intelligence, and the absence of a method of measurement independent of wages or success.

The unsatisfactory character of the opinions of the early writers is due in part to their vague conception

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[1] The writer takes pleasure in acknowledging his indebtedness to Mr. Donald G. Paterson of the University of Kansas for valuable suggestions and criticisms especially on the psychological aspects of this paper.

[2] Cf. H. L. Moore, Laws of Wages, chap. 4, and a criticism by the present writer, in this Journal, vol. xxvi, p. 787.

of the relation of heredity and environment to ability. Proximately it may be true that skill and training are the important factors in determining wages; but skill and training may presuppose general intelligence. Even Mill believed that intelligence could be diffused by education. A clear concept of intelligence in the modern view is found for the first time in Walker; but he also believed that intelligence could be gradually developed in a community as a result of long continued popular education. Taussig points specifically to the question of the origin of general intelligence: "it is not possessed by savages; it is a slowly acquired quality of civilized man."[1] Early writers were perhaps misled by inferring from the development of intelligence with age the supposed corollary that it was developed by education. We are less concerned in this paper, however, with the correctness of theories of its origin and causation than with the clear definition and measurement of intelligence.

The problem of the measurement of intelligence arose as a problem of educational psychology. How could the work of the teacher be properly measured? Were there differences in the abilities of children or were all differences due to differences in environment, training, and experience? The study of the feeble-minded gave a clue as to the importance of heredity in determining mental endowment. The problem of the measurement of intelligence attracted the attention of Binet, a French psychologist; he was commissioned in 1903 by the French government to select the backward children for special instruction. He found he had to work out a series of mental tests to determine what children were backward. Various measures had been devised to test this or that special mental characteristic or specific capacity. By an average of a series of tests, Binet suggested, a measure of *general intelligence* could be developed. The problem then was to determine what the child ought to be able to do at the various ages. This difficulty was surmounted by giving the tests selected to large numbers of children of each age, and finding from the experience of a large number of cases what the average child of each age could perform. If then a child of ten was examined and found to be able to perform only as much as an average child of six, he was termed feeble-minded, or intellectually deficient.

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[1] Principles, vol. i, p. 101.

Some modifications have been found to be necessary in the Binet tests. The Stanford revision made changes in procedure that resulted in correction of mental age of very young children and of children over ten. Both of these, the Binet tests and the Stanford revision, rate by mental age. Lately other methods of rating have been suggested. Terman suggests the use of intelligence quotients: the index computed compares a given individual with the median performance of a person of the same age. A score of 100 for a child of nine means that the child does as well as the median for that age; a score of 120 means that the child's score is 20 per cent above that made by the median child.[1] The Yerkes' point scale finds a single number representing the child's score; it can be compared to scores made by large numbers of other children of the same or different ages.[2] Another modification suggested by Pintner and Paterson is to rate children in terms of the distributions of children of the same age. A child of nine is rated for example as among the lowest 3 per cent or as a "twenty-five percentile" of the children of that age.[3] These tests have been applied also to adults. Adults with a mental age of ten years or less are termed feeble-minded.[1] Unemployed men have been tested; lately attempts have been made to secure standards for college men, for University instructors, for children of the white, Negro and Indian races, and for children of different social status.

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[1] Terman, L. M., The Measurement of Intelligence (1916).

[2] Yerkes, R. M., Bridges, J. W. and Hardwick, R. A Point Scale for Measuring Mental Ability (1915).

[3] Pintner, R. and Paterson, D. G. "A Psychological Basis for the Diagnosis of Feeble-mindedness," Journal of Criminology, vol. vii, pp. 32-55 (May, 1916).

These tests of intelligence are not the same as informational tests. The latter are based on school subjects and are designed to test the amount of school knowledge the child has acquired. Some of the more widely used educational tests are the Courtis arithmetic test, the Trabue language scales, the Harvard-Newton composition scale, and the Ayres' writing and spelling scales. They may throw light on the quality of the teaching and the value of the pedagogical methods used. A student in the eighth grade may be able to answer questions based on American history that he has just completed. But a boy who has had no schooling whatever may be shown to have equal mental ability in an intelligence test. The literacy test for immigrants is properly speaking not a test of mental ability or capacity but merely of educational opportunity. In general it requires a certain level of intelligence to pass satisfactorily the eighth grade of school or to graduate from the high school.[2] Evidence of school accomplishment may therefore be used as evidence of a corresponding minimum degree of intelligence — except in so far as backward children are promoted beyond their deserts; but the fact that a person has dropped out of school, tho frequently due to mental deficiency, is not proof of it.

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[1] The delimitation of the term "feeble-minded" is still a controversial matter. Gilliland gives a good summary of the various methods of diagnosis, with bibliography. Gilliland, A. R., "The Diagnosis of Feeble-Mindedness," Journal of Delinquency, vol. ii, pp. 22–25 (January, 1917).

[2] Terman, L. M., The Measurement of Intelligence, pp. 93, 94.

These tests are fairly reliable. Ratings of children examined by different trained workers do not vary to any considerable extent.[1] Three hundred and fifty-two feeble-minded children tested three times at intervals of a year show practically no variation in mental age. Normal children tested at different times, 464 tested by Goddard and 83 by Bobertag, show nearly the same relative rank, tho all show progress in mental development.[2] Criticisms of some of the tests have been made that they show the influence of environmental factors rather than native intelligence. The tests criticized have been eliminated in the newer methods of measuring intelligence. For present purposes the intelligence tests may be accepted as accurate measures of native endowment.[3]

The tests thus developed by the psychologists may be used to measure differences of general intelligence among wage-earners and individuals of all social classes. We have for the first time a measure of ability that is independent of reward. By correlating wages with intelligence, we shall be able to test the theory that wages are paid in proportion to intelligence. Further, and perhaps of greater significance, we shall be able to investigate the working of our present industrial system. Does our industrial order succeed in selecting the best fitted and ablest to fill its most responsible positions, or is its method an arbitrary and haphazard empiricism ? The use of intelligence tests to find correlations with wages, unemployment, choice of occupation, accidents, and many other factors offers great possibilities for drawing definite, significant, and practical economic conclusions.

[1] Kohs, S. C., "The Binet Test and the Training of Teachers," in the Training School Bulletin, pp. 113–17 (1914).

[2] Terman, L. M., The Measurement of Intelligence, pp. 112–13. Cf. chap. 7.

[3] See infra, p. 695–701.

A few studies of the relation between intelligence and earnings have been made already. Tests to determine general intelligence were applied recently to thirty applicants for positions of policeman and fireman in Los Angeles.[1] The tests were in charge of Professor Terman. In the investigation the facts as to salary received just prior to the examination were secured and correlated with the intelligence quotient obtained. A fairly high correlation, $r = +.61\ (\pm.078)$ was found between wages received and mental age. This correlation was higher than for any other factors correlated, being much higher, for example, than for spelling, handwriting, arithmetical reasoning. One of the applicants was found to be feeble-minded: he had been given a position on the force as an "extra" under the old political régime. Three others who had been appointed as "extras" were rejected without further consideration, having intelligence quotients that indicated "intellectual feebleness!" None of the applicants had completed a high school education. The investigator mentions the fact that California teachers would reach in general a much higher level of intelligence than the successful candidates for the position of fireman, tho the average wage would probably be much lower. A comparison of intelligence quotients with the impression gained by general appearance, etc., showed that one Irishman was rated much higher on appearance and social affability than his intelligence warranted.

Dr. Helen T. Woolley, Director of the Cincinnati Vocation Bureau, has made extensive tests on working children. Mental tests of children who left school and commenced work indicated that they were mentally inferior to those who continued in school. Among children who left school after the fifth, sixth, and seventh grades, no differences were found in wages received corresponding to presumed differences in mental ability; but investigation did prove that those who dropped out earlier and who showed a lower mental capacity on being tested, found difficulty in keeping their positions. The less intelligent formed a shifting class of labor.[1] An interesting sex difference was discovered. The less well endowed of the boys had the poorer and less well paid jobs: for boys of fourteen the median wage was $3.75 for the group that "failed worst," as compared to $4.10 for the group that did best; for boys of fifteen the medians were $4.75 and $5.62 respectively. Among the girls the opposite was true. For those who stood lowest in the mental tests the median wage at fourteen was $3.40 as compared to $2.85 for those who stood highest; at fifteen, $4.87 and $4.43 respectively. Dr. Woolley explains the difference by the preference of the girls for the department store work, which, tho requiring greater capacity, is more poorly paid than work in the shoe factories.[2] The figures indicate that in fixing wages, employers give greater weight to age and experience than to general intelligence in case of children just commencing work.

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[1] Terman, L. M., "A Trial of Mental and Pedagogical Tests in a Civil Service Examination for Policemen and Firemen," Journal of Applied Psychology, vol. i, pp. 16–27 (1917).

An elaborate series of tests of intelligence made upon two groups, one a group of seventeen professors and advanced students at Columbia University and the other composed mostly of unemployed and charity cases showed great differences in intelligence, which corresponded to the differences in earning capacity.[3]

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[1] Woolley, H. T., "The Issuing of Working Permits and Its Bearing on Other School Problems," School and Society, vol. i, pp. 726–33, especially p. 731 (May 22, 1915).

[2] Woolley, H. T., "A New Scale of Mental and Physical Measurements for Adolescents, and Some of Its Uses," Journal of Educational Psychology (November, 1915), pp. 12, 13.

[3] Simpson, B. R., "Correlation of Mental Abilities," Teachers College, Columbia University, Contributions to Education, No. 53, pp. 5, 6, 67–75.

A series of tests of ability to follow printed directions was given to hearing children, to business college students, and to a number of unemployed. The time required to complete the tests was lowest for the business college students, average 84 seconds; highest for the unemployed, average 309 seconds; and varied for children of different ages from nine to sixteen from an average of 178 seconds for children aged ten to an average of 123 for the sixteen-year-olds.[1] The unemployed required much more time to complete the test than the other classes, and in addition made a greater number of errors.

These studies are suggestive of the possibilities of the method of investigation. They offer a method of isolating the various factors that make up the personal qualities of labor and of correlating them with wages and other economic facts. It may prove possible to distinguish clearly and in quantitative terms the relative importance of native ability and of training and education in determining differences in wages. The results may enable the economists to discard the vague and unsatisfactory terminology of character description and permit them to substitute in place of it definite and quantitatively measurable intellectual traits. Such a step will be in line with that taken by criminology, of discarding the old, vague explanations of crime in terms of temptation and evil spirits, and testing mental condition. Pedagogy, in the treatment of backward and exceptionally bright children, is beginning to recognize the importance of native intellectual endowment or lack of endowment. Personal qualities have frequently been pointed out as a cause of unemployment of certain individuals: it may be possible to correlate unemployment in individuals with a low level of general intelligence.

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[1] Pinter, R. and Paterson, D. G., "The Ability of Deaf and Hearing Children to Follow Printed Directions," Pedagogical Seminary, vol. xxiii, pp. 477–97 (December, 1916).

Further, inquiry of this kind will throw an interesting light on the question of the influence of heredity and of environment in determining success. Is social classification based largely on ability or on privilege? Are the barriers between the non-competing groups of labor largely or entirely based on differences of ability? Such studies of intelligence and social class as have been made indicate that the brighter children are drawn almost wholly from the higher social classes. Terman states that out of 476 unselected children there was not a single one reaching an intelligence quotient of 120 whose social class was described as "below average."[1] Occasionally a child from poor surroundings may be found to be of superior intelligence, especially from among immigrant populations or populations where opportunity has not been free to all. A study of school children of Columbus, Ohio, by Bridges and Coler showed that the children of professional men, traveling salesmen, and proprietors had a mental age one to two years above the chronological age, while the children of skilled laborers had a mental age slightly less than the chronological, and the children of unskilled laborers were nearly a year retarded![2] Studies of the distribution of ability among unselected city children of Columbia, S. C., compared with children of a mill village showed that among the latter the proportion of backward children was much higher.[3] Mental tests of the capacities of Negro and white children indicate that among the Negro children the percentage of the intellectually subnormal is much larger and the proportion of bright children is much smaller than among the white.[3]

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[1] Terman, L. M., The Measurement of Intelligence, pp. 95, 117.

[2] Bridges, J. W. and Coler, L. E., "The Relation of Intelligence to Social Status," Psychological Review, vol. xxiv, pp. 28, 29 (1917).

[3] Strong, A. C., "Three Hundred Fifty White and Colored Children Measured by the Binet-Simon Measuring Scale of Intelligence: A Comparative Study," Pedagogical Seminary, vol. xx, pp. 485–515, especially pp. 501–03 (1913).

Similar studies made of Indian children at Mount Pleasant, Michigan, show that there are greater differences between the white and Indian than between the white and Negro: that the percentage of backward children is even greater among the Indians than among the Negroes.[1]

One serious criticism might be made of these conclusions. In measuring intelligence care must be taken to select tests which shall include only those really measuring native ability. Tests the results of which are affected by knowledge or environmental conditions, if applied to children of the same mental capacity but of different social conditions, will show differences that favor those who have better environment. If then a series of tests show differences in favor of children from better social environment, it is necessary to prove, before drawing a conclusion that the children of the better social class have greater intelligence, that the tests are tests really of intelligence and not of environmental factors.[2]

This question has been investigated by several writers. Stern shows that some tests are better than others for differentiating between intelligent and unintelligent normal children, between normal and feeble-minded children, and between different grades of feeble-minded. The same tests that showed the greater intellectual differentiation between normal and feebleminded also revealed the greater differentiation of children by social status.[1] Pintner and Paterson have shown that the Binet tests of naming the days of the week (omitted in the revision of 1911 by Binet) and the months of the year are dependent upon experience. Both of these were considered as nine-year old tests, i. e., the average child of nine could pass them. Two groups of feeble-minded persons were taken, one with chronological ages of less than fifteen and the other of over fifteen; in the latter group a larger proportion of individuals of each mental age ranging from three to eight passed the test than passed among the first group at corresponding mental ages. " The results of the tabulation of these cases seem to point to the fact that as a feeble-minded person grows older his ability to pass these two tests increases." [2] In another paper they show that exactly opposite results are reached with the Cube test and with the Profile test. In this case feeble-minded adults over twenty-one who tested mentally at ages ranging from five to eleven showed lower capacity to perform these tests than children fourteen years of age or below testing at the corresponding mental age. The explanation is that the adults had been rated mentally too high because of the inclusion of some tests that involved experience in the determination of mental age,[3] but that these particular tests are really tests of intelligence.

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[1] Rowe, E. C., "Five Hundred Forty-Seven White and Two Hundred Sixty-Eight Indian Children Tested by the Binet-Simon Tests," Pedagogical Seminary, vol. xxi, pp. 454–48, especially 456, 458.

[2] For purposes of correlation with wages it does not so much matter if a few tests that measure knowledge or school training are included. For school training itself is probably correlated with general intelligence, and consequently a correlation of wages even with measures of school accomplishments would be a fair substitute for a direct correlation with measures of general intelligence. Fortunately, however, the evidence indicates that the tests really measure native ability.

The most significant evidence on the question is that given by Dr. Woolley. If tests made upon school children are tests of native ability, then differences in school grade of children of equal ability are probably due to and may be explained by differences in environment. But if the tests are tests of environmental factors no marked differences between the tests made and grade in school would be expected. Dr. Woolley says:

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[1] Stern, W., The Psychological Methods of Testing Intelligence, tr. by G. M. Whipple, pp. 97, 98 (1914).

[2] Pintner, R. and Paterson, D. G., "Experience and the Binet-Simon Tests," Psychological Clinic, vol. viii, pp. 197–200, especially 198 (December 15, 1914).

[3] Pintner, R. and Paterson, D. G., "The Factor of Experience in Intelligence Testing," ibid., vol. ix, pp. 44–50 (April 15, 1915).

> On this assumption we reasoned that the fourteen year old children whose tests showed good native ability, but who nevertheless had completed only the fifth grade, must have had unfortunate social circumstances which caused retardation in school, in spite of their superior endowment; while the group whose tests showed poor native ability, but who had nevertheless completed the eighth grade at fourteenth years, must have had favorable social surroundings which assisted them through school in spite of inferior endowment. In order to test this hypothesis, we looked up in our files the records of the physical and educational history, and of home conditions of these exceptional children. We found our hypothesis absolutely verified. . . . Of the well endowed children from the fifth grade, one had been retarded by illness. This child had a good home, and good parents, but she had had in the course of her fourteen years spinal meningitis, smallpox, typhoid fever, scarlet fever, measles, and several minor diseases. She is the only child in this group who had a good home. In other cases a father had been lost through death or desertion; in some the mother was a wage-earner outside the home; in most the family was constantly moving; in only two families was the father living, one a saloon-keeper, and the other an old clothes dealer. The social conditions of the poorly endowed children in the eighth grade was uniformly good. In practically all cases the father was the wage-earner; not one mother was a wage-earner outside the home. Over half of the families owned their homes, while none of the families with well endowed children in the fifth grade did. Most of the mothers were interested in education, and the children in most cases did not have to do any work out of school. " To find the apparent anomalies in the estimates made by the scale so uniformly explicable on social grounds is an important piece of evidence in favor of the reliability of the scale as a measure of native mental ability." [1]

Studies of general intelligence, if carried far enough, may offer a sound basis for vocational guidance. Mental tests may be made to determine the average degree of intelligence required of motormen, of ditch-diggers, of locomotive engineers. Dr. Woolley suggests that manual dexterity may or may not be correlated with intelligence, and that a study of relative aptitude for mental and manual work might be used for vocational guidance. A boy who was intellectually below par but who had some manual dexterity ought to be given industrial training. Education should be adapted to the capacities of the individual.[1] Pintner and Paterson, in a study of the language ability of deaf children, point out the poverty of their language attainments, very few reaching more than fourth grade ability. It follows as a corollary that education of the deaf ought to be directed along lines of manual or industrial training where they are relatively not seriously handicapped instead of into the study of languages and literatures like English and Latin, in which they are notably deficient.[2] Special aptitudes along special lines may be discovered by special tests. Whipple suggests, for example, auditory tests for telephone operators, tonal discrimination for children studying music, etc.[3] Most of these tests will permit only of negative conclusions: the general level of intelligence requisite for success in a given vocation may be determined, and persons without sufficient endowment of intelligence can be advised against undertaking employment where they will almost certainly fail.[4]

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[1] Woolley, H. T., " A New Scale of Mental and Physical Measurements for Adolescents, and Some of Its Uses," Journal of Educational Psychology, November, 1915, pp. 6–8. See also, Terman, The Measurement of Intelligence, chap. 7.

Mental tests will probably have wider application in the selecting of employees by employers. The best candidates among applicants for a position may be selected by means of tests of general intelligence. Progressive employers are looking for some method of selection that is not haphazard; if they have to give employees a course of training, as is true in many employments, such as telephone exchange or electrical work, they wish to be sure that they are not wasting the training on those who will not be able to do what is expected of them. Whether general intelligence tests are the best for a particular kind of work or employment can be determined only by experience. For some kinds of work it is possible that special tests would be better or that supplementary tests would be necessary. The value of these tests is that they are standardized and the results can therefore be better interpreted. Tests might be applied to all candidates for civil service positions; and it has been suggested that they might be of great value in selecting recruits for the army.

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[1] Woolley, H. T., A New Scale, p. 14.

[2] Pintner, R. and Paterson, D. G., "A Measurement of the Language Ability of Deaf Children," Psychological Review, vol xxiii, pp. 424–29.

[3] Whipple, G. M., "The Use of Mental Tests in Vocational Guidance," Annals of the American Academy of Political and Social Science, vol. lxv, pp. 193–204 (1916).

[4] Terman, L. M., The Measurement of Intelligence, p. 49.

It is doubtless premature to attempt a formulation of the relation of wages and intelligence on the basis of the meager evidence thus far available. Possibly it might run as follows. There is a tendency for wages in a given occupation to vary with the degree of intelligence; but in the early years of employment age and experience appear to have more weight. Occupations can be classified with reference to the amount of intelligence required. The supply of labor in many occupations is limited by the supply of labor of requisite intelligence available. Frequently there are strong preferences on the part of intelligent labor for particular kinds of work, and the wages in these desirable occupations are correspondingly reduced. These preferences may be revealed through correlations of intelligence and wages by occupation. Education and training may prove to be more directly correlated with wages than is general intelligence: but it is probable that the degree of education and training that can be taken with advantage is directly dependent upon native ability. Other personal qualities that still remain unmeasured — the moral traits of honesty, faithfulness, dependability, and personal habits that might affect the availability of men for special work — may possibly prove to be correlated with general intelligence. Differences in wages due to differences in health and physical efficiency, differences due to political and industrial privilege and "pull" may be more definitely measured after differences due to mental ability and training are eliminated.

Only a beginning has been made. We need more measurements and correlations of intelligence with various economic factors. We should keep in touch with the work of the psychologists in developing and applying these tests. We need to reëxamine and test our conclusions by a close study, aided by this new method of measurement of intelligence, of the facts and processes of our industrial life.

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